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LTV STEEL COMPANY
CHICAGO DISTRICT
BLAST FURNACE CAST HOUSE
PARTICULATE EMISSION TESTS

EPA Region 5 Records Ctr.



307742

January 1981
LTV STEEL - GENERAL OFFICE
Environmental Control Department

INTRODUCTION

Particulate emission tests were conducted on the Republic Steel Corporation - Chicago District Blast Furnace Cast House on January 14 and 15, 1981. The testing was performed by the Republic Steel - General Office Environmental Control Department and was witnessed at various times by the following individuals:

U.S. EPA

Dan Bakk
Ed Zylstra
Terry Moan
Bill Simes
Frank Ekman
Chuck Mackus

Illinois EPA

Cezary Krzymowski
Fred Smith
Rico Vallejera
Joe Ochsenfeld
Kerry Keller
Harish Narygen
Gary Suanosa

City of Chicago
Department of
Inspectional Services

Jerzy Sakolowski

Citizens for a Better
Environment

Kevin Greene
Bob Goldsmith

Testing was conducted in accordance with a protocol based upon Illinois Pollution Control Board Regulation, Particulate Emissions from Steel Mills, Rule 203(d)(5)(D)(i) Blast Furnace Cast Houses, September 6, 1979, as modified by Republic Steel and amended during its development to incorporate, to the extent feasible, recommendations made by the U.S. EPA, Illinois EPA, and the City of Chicago Department of Inspectional Services. Each test was initiated with the opening of the tap hole and was terminated with the plugging of the tap hole. During the test period, the cast house roof monitors were closed and the particulate emissions from the casting operations were directed through the annular opening between the furnace shell and the cast house roof, an area of 350 sq. ft. Particulate emissions, collected at eight points in this area, were drawn to the cast house floor for eventual gravimetric analysis.

SUMMARY OF RESULTS

The average emission for the six casts tested was 33.4 lb/hr. This compares with the average allowable emission rate of 68.2 lb/hr, calculated using the appropriate equations as specified in Rule 203(a) of the Air Pollution Code of Regulations of Illinois based on the hourly process weight rate in tons of iron and slag for each cast. A summary of the test results is presented in Table I. Additional test data are presented in Table II and furnace operating parameters are given in Table III. Copies of the sampling test protocol, raw data sheets, work sheets, sample calculations, equipment calibrations, weather data, blast furnace casting logs and equipment lists are included in the Appendices.

TEST PROCEDURE

The test protocol is included in this report as Appendix 1. Opacity observations of the casting operations were performed during the test run by the use of U.S. EPA Method 9 Procedure as published in the FEDERAL REGISTER, Thursday, August 18, 1977.

TABLE I

LTV STEEL COMPANY
Chicago District
Blast Furnace Cast House
Summary of Test Results

Cast No.	3214	3215	3216	3220	3221	3222	Avg.
Date	1-14-81	1-14-81	1-14-81	1-15-81	1-15-81	1-15-81	
Cast Duration (hrs)	0.46	0.98	0.87	1.15	0.59	0.96	
Flow Rate Leaving Cast House (dscfm)	148,500	84,300	127,900	109,600	126,400	115,100	
Process Wgt; Iron & Slag (tons)	247	418	608	700	377	480	
Emission Rate (lbs/ton process wgt)	0.046	0.059	0.048	0.055	0.032	0.125	
Hourly Process Wgt; Iron & Slag (tons/hr)	537	427	699	609	638	500	
Emission Rate (lb/hr)	24.7	25.1	33.8	33.5	20.7	62.5	33.4
Emission Rate Allowable (lb/hr)	67.8	64.5	70.7	69.2	69.7	67.0	68.2

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TABLE II

LTV STEEL COMPANY
Chicago District
Blast Furnace Cast House
Particulate Emission Test Data

Cast No.	3214	3215	3216	3220	3221	3222
Date	1-14-81	1-14-81	1-14-81	1-15-81	1-15-81	1-15-81
Avg. Annulus Exit Velocity (ft/min)	540	488	491	421	436	470
Avg. Annulus Exit Temperature (°F)	120	124	128	128	121	135
Annulus Exit Moisture (%)	13.5	23.5	17.1	17.5	9.3	21.6
Annulus Exit (Barometric) Pressure (in. Hg)	29.86	29.89	29.91	30.03	30.07	30.09
Total Annulus Exit Flow Rate (dscfm)	148,500	84,300	127,900	109,600	126,400	115,100
Total Sample Volume (dscf)	668	1315	1262	1633	1035	1253
Total Sample Wgt. Collected (grams)	0.8394	2.9665	2.5217	3.7760	1.2833	5.1422
Particulate Concentration x 10 ⁶ (lb/dscf)	2.77	4.97	4.41	5.10	2.73	9.05
Particulate Concentration (grains/dscf)	0.019	0.035	0.031	0.036	0.019	0.063

TABLE III
LTV STEEL COMPANY

Chicago District
Blast Furnace Cast House
Furnace Operating Parameters

Cast No.	3214	3215	3216	3220	3221	3222
Date	1-14-81	1-14-81	1-14-81	1-15-81	1-15-81	1-15-81
Start Time	9:03 am	11:54 am	3:25 pm	7:25 am	11:15 am	2:20 pm
Finish Time	9:30 am	12:51 pm	4:17 pm	8:34 am	12:51 pm	3:18 pm
Duration (min:sec)	27:36	58:36	52:04	68:42	35:40	57:29
Duration (hrs)	0.46	0.98	0.87	1.15	0.59	0.96
Process Wgt.-Hot Metal (tons)	196	332	483	556	299	381
Process Wgt.-Slag (tons @ 519#/ton hot metal)	50.86	86.15	125.34	144.28	77.59	98.87
Total Process Wgt. (tons)	246.86	418.15	608.34	700.28	376.59	479.87
Hourly Process Wgt. (tons/hr)	536.66	426.69	699.24	608.94	638.29	499.86
Tap Hole Depth (ft)	5.0	5.5	5.5	5.5	5.0	5.0
Tap Hole Drill Bit Dia. (in.)	2.5	2.5	2.5	2.5	2.5	2.5
Daily Charge Wgt. (tons/24 hr)	6408	6408	6408	6253	6253	6253

or

Opacity observations by William Uskert, a certified opacity observer, of Republic Steel - Chicago District Environmental Control Department are included in Appendix 2.

ANALYSIS OF TEST PROCEDURE

Except for the points discussed below, the test proceeded in conformance with the test protocol (see Appendix 1).

Three of the eight anemometers, Nos. 2, 3, and 4 as shown in Figure 2, Appendix 1, did not function during the test period. None of these anemometers was in juxtaposition. The remaining five anemometers, which operated properly during the test period, were so arranged in the annulus area as to produce measurements representative of total exhaust air velocities. Pretest observations of all eight anemometer readings showed little variation in the air flow velocity throughout the entire annulus area, and observation of the average velocities at the five operating anemometers during the test period showed that the air flow velocity was also uniform throughout the roof annulus area. Therefore, the three non-functioning anemometers cannot be reasonably expected to adversely affect the validity of the test results since the five operating anemometers were representative of the actual air flow throughout the annulus area. The velocities registered by the five operating anemometers were averaged and used in calculating the total air flow leaving the cast house.

There were two complete sampling systems, each sampling emissions from one-half of the roof annulus area. They are identified as System 1 and 2, containing control Sections 1 and 2, and System 3 and 4, containing control Sections 3 and 4. Both total duct work systems were conditioned on January 13, 1981 in accordance with Section 3 of the test protocol, Appendix 1, at which time Casts 3208 and 3209 were sampled, each followed by a 30-minute purge cycle.

High flow rates and the configuration of the two filter-two blower purge system may have contributed to the rupture of five of the 24 filters used in the purge portion of the testing. The ruptured filters were not soiled on the backside, indicating that these filters most likely broke due to back pressure in the sampling duct system when the blowers were turned off. The filter catch during the purging operation was therefore not affected by the rupture of filters, as further demonstrated by the fact that the filter catch during the purge operation was consistent for both ruptured and non-ruptured filters.

The filters found ruptured following the purge cycles are as follows:

Cast No. 3214	Filter Location Purge 3 and 4
3215	1 and 2
3216	None
3220	1 and 2
3221	1 and 2
3222	1 and 2

The particulate mass contribution due to the purge averaged less than five percent of the total test particulate catch. The flow rate during the purge averaged 41 acfm for System 1 and 2 and averaged 33 acfm for System 3 and 4. These flows produce velocities in the ducts which are respectively 2.2 and 2.7 times higher than the average flow during the sampling periods.

During the sampling periods, the isokinetic rate averaged 56 percent. Any bias caused by this sampling rate will result in a reported emission rate slightly higher than the true emission rate and therefore will not affect the validity of the test.

Where there was a change in the calibration of the sampling equipment from before testing to after testing, the calibration which resulted in the higher emission rate was used. The calibrations of all equipment used are included in the attachments to Appendix 1.

Appendix 1	Protocol Attachments A-F Equipment Calibrations
Appendix 2	Visible Emission Readings
Appendix 3	Sample Calculations Including Annulus Area
Appendix 4	Equipment List
Appendix 5	Blast Furnace Casting Logs
Appendix 6	Weather Information
Appendix 7	Data Sheets and Work Sheets

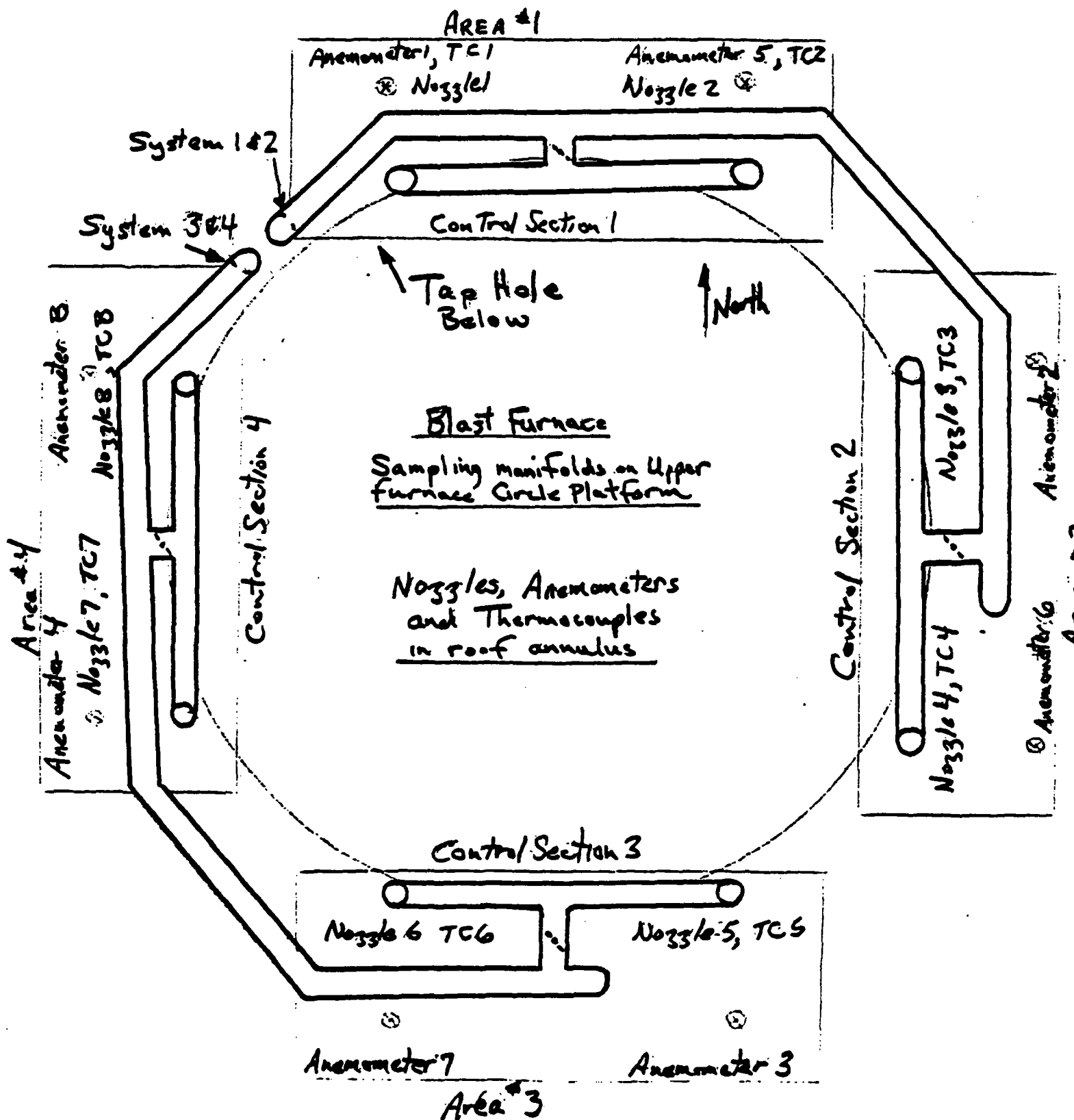


Figure 2
LTV STEEL COMPANY - CHICAGO DISTRICT BLAST FURNACE
Cast House Particulate Mass Emission Test Hi-Volume - Manifold
Test Protocol Schematic